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Energy-saving practices among postgraduate students: A case study at the Pan African University

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ABSTRACT

Currently, energy efficiency with energy conservation are key topics that are in discussion among various scholars and communities. Energy efficiency is influenced by energy savings. In the modern era of development, energy saving is believed to be tackled through two main approaches: (1) change in behavior and (2) development of new technologies. Thus, this study aims to assess postgraduate students' practices and behavior on energy-saving living in the Olatunde Runsewe and Adebayo Akande Halls at the Pan African University Life and Earth Sciences Institute in Nigeria. To achieve this aim, a questionnaire survey was administered to collect data from the students, and Pearson correlation was used to explore the relationship between sociodemographic information and students' energy-saving practices. The findings were interpreted and presented in terms of themes, figures, and tables. The findings showed positive and negative significant effects among the sociodemographic data and students' energy-saving practices. Most of the respondents are aware of the costs paid for electricity, while less than half of them believe that the costs paid for accommodation are reasonable compared to the services provided in the rooms. Moreover, most respondents switched off electrical appliances when they were not in use. It is recommended that further empirical studies should be conducted to assess the interactions between sociodemographic factors, students' energy-saving practices and governmental policies and regulations relating to energy.

Keywords: energy supply and use, energy-saving, energy-saving practices, personal knowledge

INTRODUCTION

Currently, the world is more attentive to sustainable development (SD). Access to reliable, affordable, sustainable, and modern energy for all people is one of the SD goals (Yetano Roche et al., 2019). Energy resources can be non-renewable or renewable; however, currently, the world is dominated by the use of non-renewable energy such as fossil fuels (Kåberger, 2018; York & Bell, 2019). The contribution of renewable energy use globally remains low. For instance, only 18% of the energy consumed globally for heating, power, and transportation was from renewable sources in 2017 (Gielen et al., 2019).

Energy consumption has been increasing globally. For instance, global energy consumption grew rapidly at a rate of 2.9%, led by natural gas and renewable energies in 2018 (BP, 2019). Increased energy consumption has been influenced by the increase in energy demand worldwide. The global energy demand is initiated by the rapid growth of industrialization and population, by which more fossil fuels such as oil, coal, and natural gas are depleted to meet this demand (Bishoge et al., 2020b). Energy consumption also varies from one nation to another (Zaharia et al., 2019). For instance, China is leading, accounting for 23.6%, followed by the United States (16.6%), European Union (14%), Russia (5.2%), Japan (3.3%), Africa (3.3%), and Canada (2.5%) (BP, 2019). The major energy-consuming sectors are industrial, transportation (especially public transit systems), residential, and commercial.

The increased use of energy has stimulated climate change problems globally. There is a gradual increase in greenhouse gas emissions from various sources of energy. The primary greenhouse gases in earth's atmosphere are carbon dioxide (CO_2), methane (CH_4), and water vapor (H_2O). Others include sulfur dioxide (SO_2), chlorofluorocarbons (CFCs), ozone (O_3), and nitrogen oxide (N_2O) (Coe et al., 2021). The increase in these gases in the atmosphere leads to global climate change, stratospheric ozone layer depletion, and acid rain. The emission of CO_2 gases is considered a major greenhouse gas globally. There is an emission of over 36 million tons of CO_2 per year globally, and this continues to increase (Ritchie & Roser, 2019).

Currently, China is the world's largest CO_2 contributor, accounting for over one-quarter (28%) of the global emissions followed by the United States (15%), European Union (10%), India (7%), and Russia (5%) (Bishoge et al., 2019). However, the United States has contributed much of the global CO2 emissions with 25% of cumulative emissions, followed by the European Union (22%), China (13%), Russia (6%), and Japan (4%) (Ritchie, 2019). CO_2 emissions differ between developed and developing countries. The world's poorest countries contribute less than 1% of global emissions, but they are most vulnerable to climate change impacts (Ritchie & Roser, 2019).

Since energy access is considered a key pillar for human well-being, economic development, and poverty alleviation, every country is trying to secure energy through energy consumption efficiency. More efforts are being made to ensure energy efficiency at the individual to global levels. Energy efficiency minimizes the amount and cost of energy imports and the likelihood of supply interruptions. It ensures both short- and long-term energy security in a cost-effective way (IEA, 2019). Thus, to achieve energy consumption efficiency because of the increase in energy use, one should consider its management. Energy demand and consumption management is part of a solution to the energy crisis and climate change problems (Farghali et al., 2023). This helps to reduce the costs of electricity supply and use and balances energy efficiency to reduce greenhouse gas emissions (Zierler et al., 2017).

Currently, energy efficiency with energy conservation are key topics that are in discussion among various scholars and communities. Energy efficiency is influenced by energy savings. In the modern era of development, energy saving is believed to be tackled through two main approaches:

(1) change in behavior and

(2) development of new technologies (Bizon et al., 2017).

All of these approaches aim to save energy during applications. Energy efficiency has recently become a challenge for different scholars, including economists, engineers, scientists, and environmentalists. However, in recent years, the increased public concern for natural resource conservation and environmental protection has gained great attention for research and development activities in this area.

Energy conservation is an effort made to reduce the consumption of energy by using less of an energy service. It is a part of eco-efficiency. This can be achieved using energy more efficiently by either using less energy for constant services or reducing the amount of energy used. It reduces the need for energy services and can result in increased environmental quality, national security, personal financial security, and high savings. It is at the top of the sustainable energy hierarchy and lowers energy costs by preventing future resource depletion. As explained before, energy can be conserved by reducing wastage and losses, improving efficiency through technological upgrades, changing individual and organizations' behaviors on the use of energy, and improving operation and maintenance. On a global level, energy use can also be reduced by the stabilization of population growth. Thus, energy saving is considered a part of energy conservation.

Change in behavior among society that uses energy is one of the vital approaches that can be applied to save energy. It is through various ways that society can change their behaviors on energy consumption to realize energy efficiency. In most cases, raising awareness among individuals or groups of people increases the chance of changing their behaviors towards something. Awareness can be achieved through the dissemination of informal or formal education, which is the key to achieving SD in any country. The increase in scientific and technological efforts requires many contributions of education about how these efforts may be imparted to society. The main aim of education is to provide skills and knowledge to the public and introduce basic concepts and practices through appropriate determination. Skills usually change people's perceptions and altitude on something.

To achieve energy development, sufficient awareness among the public is required. The lack of education among the public on energy production, supply, and use may lead to dysfunction of the energy sector and thus affect energy security and access in the country. Awareness and knowledge among the community is a key tool for achieving sustainable energy development in any country (Żywiołek et al., 2021). Moreover, every individual should be aware of issues related to environmental conservation in energy sources, production, and use.

Institutional operations and logistics are considered as the aspects by which energy consumption can be handled. However, the most important aspect is the change in behaviors and attitudes of energy users at different levels. Behavior change and energy use draw on a proof from behavioral economics and psychology to outline a new approach to enabling people, at home and at work, to reduce their energy consumption by reducing their bills in the process. The reduction of total energy consumption at an individual level is considered to transform current energy systems around the world (Kalair et al., 2021). The sustainable use of energy increases energy efficiency. Energy efficiency "*is the most cost-effective way of cutting carbon dioxide emissions and improvements to households and businesses*" (Min et al., 2022).

Energy efficiency is a relative term used to describe how effectively energy is used in various sectors. This comes with the idea of saving energy, which is a key tool for SD. different ways of using energy in society can be determined by people's social system and culture, leading them to automatically uphold energy consumption behaviors. Through interactions between cognitive and contextual norms, material culture, and energy practices, people's energy consumption behaviors can be realized (Bavaresco et al., 2020).

Various studies have been conducted regarding energy consumption behaviors for energy saving in different countries. These studies focus on the individual and organizations' behaviors and attitudes towards energy saving. Their results differ from one country to another, individuals to other individuals, and organizations to other organizations. However, in Nigeria, there is little information on energy consumption attitudes and behaviors towards energy-saving among the individuals and organizations. Second, no empirical study has been conducted to assess the attitudes and behaviors among the youth on energy use and saving. Thus, it is important to assess the awareness, attitudes and behaviors of the youth towards energy use and saving at the university level in Nigeria. This is because Nigeria, like other countries,

is obliged to save energy to realize SD but also there is also an increase of attention for more studies on energy-saving behaviors from across the world.

To achieve this aim, the study was conducted with students at Pan African University Life and Earth Science Institute (PAULESI), University of Ibadan. This is because university students living in hostels/halls represent unique consumers who are directly involved in the payment of electricity bills. The energy consumption behavior practiced by university students is an important indicator of energy sustainability (Ali & Anufriev, 2020). This is the reason why this study was conducted with these students. To achieve this, the following questions were addressed:

1. What is the understanding of the students regarding energy consumption efficiency?
2. What are the appliances used by the students in their living rooms?
3. What are the energy-saving practices engaged by the students within the halls/hostels?

MATERIALS AND METHODS

Survey Design

Simple random sampling techniques were employed to select participants for the questionnaire. The sample size was selected from a total of admitted 80 first-year postgraduate students (27 PhD and 53 masters) of PAULESI, University of Ibadan, Ibadan, Nigeria for the 2019/2020 academic year (PAULESI, 2020) and who are currently living in Adebayo Akande Hall and Olatunde Runsewe Hall. Thus, a sample size of 40 students was selected using the formulae proposed by Israel (2012) for quantitative studies like the current study: $n = \frac{N}{1+N(e)^2}$, where n is sample size, N is total number of the population (80), and e is margin of error (sampling error) set at 5% (0.05) and a confidence level of 95%. Using the above formula, sample size is calculated, as follows: $n = \frac{80}{1+80\ (0.05)^2} =$ 66.6. The formula gives an approximate 66 sample size.

Development of the Questionnaire

A questionnaire was prepared for the respondents. Each questionnaire set consisted of closed-ended questions and a few open-ended questions on opinions and attitudes concerning energy use and saving. The questionnaires for this study were adopted and modified from variables in various studies previously used in almost similar studies in China (Sun & Feng, 2011; Zhao et al., 2019); in Britain (Trotta, 2018); in Australia (Frederiks et al., 2015); and in Greece (Lefkeli et al., 2018).

The questionnaire used in this study was divided into three sections with 28 questions. The first section included general questions on respondents' particulars (including gender. age, marital status, degree program, and place of living). The second part consisted of questions on students' awareness of energy consumption costs. The final section describes the energy-saving behaviors practiced by the students.

To ensure and assess the validity of the questionnaire and identify uncertain issues, a pilot study survey (n = 5) was conducted with university students with the same characteristics as the study population. The content of the questionnaire was modified by deleting the irrelevant questions, reorganizing, reconstructing, and restructuring questions based on feedback after testing. The questionnaire considered five possible factors that influence students behavior on energy saving. These factors include basic information, energy-saving awareness, energy-saving knowledge, energy-saving attitudes, and appliances.

Data Entry, Management, and Analysis

Data entry was performed using the SPSS for Windows software package version 20.0. Data were tabulated, checked, and evaluated, and then transformed into numbers. Frequencies were run to determine the percentage of responses for various items in the questionnaire. Pearson correlation was used to reveal the relationships among the questionnaire results (study variables). Furthermore, the researcher employed information from previously evaluated and assessment sources, such as academic journals, articles, newspapers, and electronic materials, to provide further clarification on the study.

RESULTS AND DISCUSSION

Respondents' Characteristics

Of the 66 responses that were received, 17 were invalid, while 49 (74%) were valid. From **Table 1**, 28 (57.1) respondents were female while the remaining (42.9%) were male. 75.5 aged between 26 and 35 years, representing the highest participation rate. Over two-thirds (79.6%) of the respondents were not married. About 10 (20.4%) of the respondents were postgraduate students (MSc and PhD) majoring in environmental management, representing the highest participation rate, followed by students majoring in reproductive health (12.3% and students majoring in petroleum geosciences and plant breeding (12.2%). Additionally, over half (61.2%) of the respondents lived in Olatunde Runsewe Hall, while the remaining (38.8%) lived in Adebayo Akande Hall.

Relationship Between Personal Information and Personal Attitudes and Behavior on Energy Use

Respondent's information and study variables were categorized into summarized data analysis. Data distribution was recognized as normal. A parametric test (Pearson correlation) was performed to identify the significant effects of all respondents' demographic information and study items, as indicated in **Table 2**.

While some results showed positive and negative significant effects among the respondents' data, others showed no significant effect on some items. Gender significantly influences the study item of *whether the cost paid for accommodation is sufficient to cater to energy demand*. Both age group and marital status significantly influence *awareness of energy consumption on energy supply and use in the rooms*. They also significantly influence *energy-saving behaviors practiced by students on the practice of switching off the lights when the students leave the room*.

Table 1. Respondent demographic characteristics (n = 49)

Variable	Scale	F	P
Gender	Female	28	57.1
	Male	21	42.9
Age group	18-25	8	16.3
	26-35	37	75.5
	36-40	4	8.2
Marital status	Single	39	79.6
	Married	10	20.4
Degree program	MSc in environmental management	5	10.2
	MSc in petroleum geosciences	3	6.1
	MSc in mineral exploration	2	4.1
	MSc in avian medicine	2	4.1
	MSc in vaccine production and quality control	3	6.1
	MSc in reproductive biology	3	6.1
	MSc in reproductive health	4	8.2
	MSc in medicinal plant research	2	4.1
	MSc in plant breeding	3	6.1
	MSc in sports management and policy	4	8.2
	PhD in mineral exploration	2	4.1
	PhD in petroleum geosciences	3	6.1
	PhD in reproductive health	2	4.1
	PhD in reproductive biology	3	6.1
	PhD in environmental management	5	10.2
	PhD in plant breeding	3	6.1
Place of living	Olatunde Runsewe Hall	30	61.2
	Adebayo Akande Hall	19	38.8

Note. F: Frequency & P: Percentage

Also, degree program significantly influences *the students' understanding of how much it costs for accommodation per day or month and whether the students switch off their air conditioner frequently*. Lastly, the hall of resident influences the students' behaviors by switching off the air conditioning (AC) and filling the electric kettle when they want just cups of tea or water.

Students' Knowledge and Awareness of Energy Consumption Costs

Awareness and knowledge of energy costs are required of electricity consumers to ensure a good relationship between service providers and consumers (Bavaresco et al., 2020). The sustainability of energy supply and use requires consumers to be aware of how much electricity should be used and its costs (Trotta, 2020). Thus, a better understanding of consumers' perceptions of energy use and savings is needed to ensure effective strategies for energy savings (Fredericks et al., 2020).

This study aimed to understand whether students are aware of knowledgeable about costs for accommodation and its breakdown and electricity. As indicated in **Table 2**, over 95% of the respondents argued that they were aware of the cost of accommodation per day or month. The accommodation in the hostel entails many facilities such as electricity, a kitchen, and playgrounds. All of these facilities have different costs.

From this study (**Table 3**), it was revealed that over 81% of the respondents do not know how much each facility costs, while only 16% are aware of it. This is because of reasons such as

(1) the cost of accommodation is paid in a lump sum (including other bills),

(2) no proper communication channel,

(3) satisfaction with the cost of accommodation, and

(4) tight schedule, as reported by some respondents in **Figure 1**.

Table 2. Results of the parametric test (n = 49)

Variable	Study item	Parametric test (p-value** and*)				
		1	2	3	4	5
Awareness of energy consumption	Do you know how much it costs for accommodation per day or month?	-0.179	0.035	-0.104	-0.321*	-0.164
	Have you ever been asked about the breakdown of accommodation costs/bills?	0.000	0.251	0.054	-0.202	-0.030
	Do you know how much electricity it costs in your room/dormitory per day or month?	0.215	-0.176	-0.068	-0.135	0.016
	Is the cost paid for accommodation sufficient to cater to energy demand?	0.310*	0.069	-0.209	0.040	0.180
	How do you rate the cost of accommodation compared to the services provided in the room?	0.070	-0.061	-0.269	0.074	0.208
	Which energy-consuming appliances do you own?					
	Do you have any challenges with energy supply and use in your room?	-0.226	-0.290*	-0.334*	-0.143	-0.074
Energy-saving behaviors practiced by students	What type of light bulbs do you use?	0.258	-0.050	0.151	0.156	0.237
	How frequently are you involved in switching off appliances in your room/dormitory per week?	-0.018	0.160	0.282	0.000	-0.065
	Do you switch off the lights when you leave the room?	-0.110	-0.488**	-0.288*	0.154	-0.064
	Do you switch off the lights when you are asleep at night?	-0.191	-0.354*	-0.107	0.143	-0.159
	Do you switch off your computer laptops or desktops when they are not in use?	-0.192	-0.073	-0.288*	-0.212	-0.232
	Do you put the computer laptops or desktops on sleep mode when they are not in use?	-0.157	-0.267	-0.137	0.093	0.079
	Do you switch off your phone when you fall asleep?	0.143	-0.459**	0.096	0.147	0.069
	Do you switch off the lights in the kitchen after cooking or heating your food?	-0.028	-0.245	0.321*	-0.191	0.097
	Do you switch off the fridge when it is not in use?	0.185	-0.268	0.146	0.205	0.208
	Do you switch on the air conditioning?	0.042	0.113	0.111	0.357*	0.325*
	Do you fill the electric kettle when you need just a cup of water?	0.271	-0.016	0.281	0.166	0.396**
	Do you always use warm water for bathing?	0.253	0.029	0.015	0.194	0.018
	To be sincere, how would you rate yourself on energy-saving practices in the room or dormitory?	-0.123	0.148	0.255	0.101	0.095
	Are you satisfied with the energy services provided in the room/dormitory?	0.195	0.267	0.273	-0.015	-0.217

Note. Correlation scales: 1. Sex, 2. Age group, 3. Marital status, 4. Degree program, & 5. Hall of resident & **p < 0.01 & *p < 0.05

Table 3. Students' knowledge and awareness of energy consumption costs (n = 49)

No	Study item	Response (%)		
		Yes	No	Not sure
1	Do you know how much it costs for accommodation per day or month?	95.9	4.1	-
2	Have you ever been asked about the breakdown of accommodation costs/bills?	16.3	81.6	2.0
3	Do you know how much it costs for electricity in your room/dormitory per day or month?	36.7	59.2	4.1
4	Is the cost paid for accommodation sufficient to cater to energy demand?	83.7	12.2	4.1
5	Do you have any challenges with energy supply and use in your room?	22.4	77.6	-

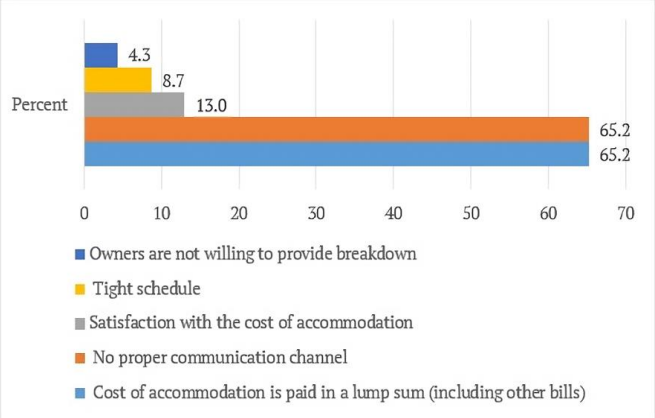

Figure 1. Reasons for not asking about accommodation cost breakdown (responses in %) (n = 49) (Source: Authors' own elaboration)

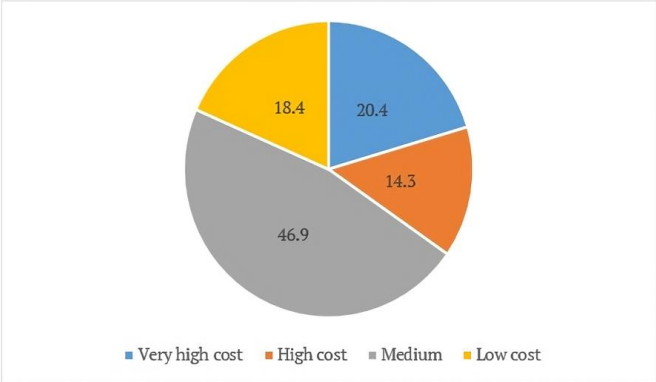

Figure 2. Respondents' rate (in percent) of accommodation cost compared to services provided in the room (n = 49) (Source: Authors' own elaboration)

The cost of accommodation is paid in a lump sum (including other bills), and no proper communication channel was cited in 65.2% of the respondents. This implies that the hall administration has no proper communication channels for their students regarding energy matters. Proper communication channels enhance energy-saving practices in the residential areas. For instance, Fredericks et al. (2020) suggest that the combination of public and private information motivates a 20% reduction in electricity consumption achieved through low heating and cooling uses.

However, interestingly, over 59% of respondents were aware of the costs for electricity in the room, and about 83% of respondents believed that the cost paid for accommodation was enough to cater for energy demand. The Pan African University administration reported that each student is obliged to pay a total of 30,000 naira (equivalent to 79 USD) and 40,000 naira (equivalent to 104 USD) per month as accommodation fees in Olatunde Runsewe and Adebayo Akande Halls, respectively. Interestingly, each room accommodates only one student. This amount covers all services provided in a room, including water and electricity.

Table 4. Top-energy users in homes

No	Appliance	Percentage of energy use
1	Cooling and heating	47
2	Water heater	14
3	Washer and dryer	13
4	Lighting	12
5	Refrigerator	4
6	Electric oven	4
7	TV, DVD, and cable box	3
8	Dishwasher	2
9	Computer	1
Total		**100**

Likewise, as shown in **Figure 2**, approximately 46% of the respondents believe that the cost of accommodation is good compared to services provided in the room, while 20% argued that the cost paid for accommodation is very high.

Use of Energy-Consuming Appliances in Halls

It is not easy to evaluate energy-saving behaviors without considering the energy-consuming appliances used by the energy users. There are various energy-consuming appliances with different rates, including cooling and heating, water heaters, and lighting as presented in **Table 4**. Cooling and heating appliances dominate the use of energy in homes, especially in developed countries (Ürge-Vorsatz et al., 2015).

This study revealed the use of different energy-consuming appliances in dormitories, as shown in **Figure 3**. The use of mobile phones and computer laptops was reported by the majority (92.6%) followed by electrical irons, refrigerators, and heaters with 66.7%, 44.4%, and 40.7%, respectively. According to Ahmad (2020) and Nogry and Varly (2018), most students use mobile phones and laptops as learning tools. These findings concur with those of Kamunda (2014), who reported that electrical-cooking stoves, water heaters, dry irons, and incandescent bulbs were the most electrical power-consuming appliances in households.

From this study, electric cookers, hot plates, and electrical kettles were reported by few respondents (3.7%) as energy-consuming appliances. It is believed that most of the students use the kitchens in the dormitories to cook food and heat water. This was observed by the researchers when they visited the dormitories. Moreover, administration from both halls prohibits the use of cooking and heating water in the dormitories.

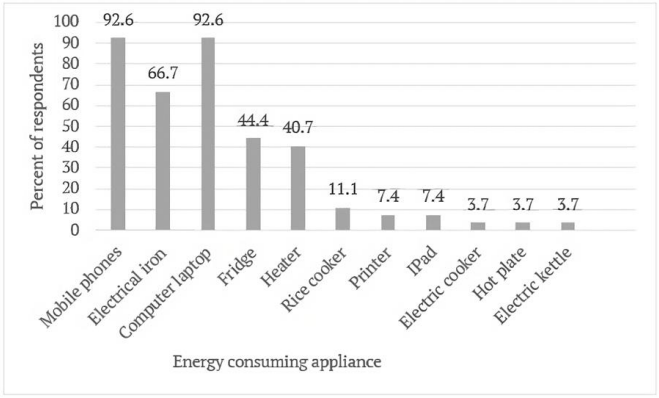

Figure 3. Type of energy appliances owned by students (n = 49) (Source: Authors' own elaboration)

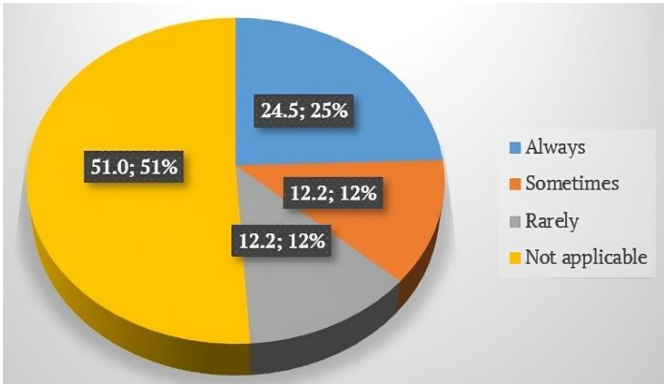

Figure 4. The practice of switching off the lights in the kitchen after cooking or heating food or tea (n = 49) (Source: Authors' own elaboration)

Energy-Saving Behaviors Practices

Understanding human attitudes and behaviors on energy saving begins with studying and understanding their practices such as switching off energy-consuming appliances when they are not in use (Canova & Manganelli, 2020). Leaving energy appliances on when they are not in use indicates bad energy-saving behaviors (Leygue et al., 2017). This study therefore aimed to understand whether students switch off appliances or not when they are not in use. From **Table 5**, the responses from the students were positive on switching off the lights when they left the rooms or fell asleep at night with about 75% and 83%, respectively. This provides a good impression on the students' attitudes and behaviors towards energy saving. These findings coincide with those of Zhao et al. (2019), who revealed that 77% of university students in Macau turn off the lights when they leave their rooms.

The use of laptops or computers as household electronic devices adds to the electricity cost (Fletcher & Malalasekera, 2016). It was found that over half (59.2%) of the respondents reported switching off their laptops when they were not in use. It is recommended to turn off computers or laptops when they are not in use to save a bit of money on the electricity bill (Dileep, 2020). Moreover, only 42.9% of the respondents reported that they put their laptops on sleep mode when they were not in use.

Currently, mobile phones have become an essential tool in daily life (He et al., 2020). Most students own and use mobile phones. The use of mobile phones is associated with various benefits for communication but with some disadvantages in terms of energy use and human health. From this study, approximately 83.7% of the respondents reported not to switch off their mobile phones when they get asleep. However, it is better to power off or turn off the phones in aero plane mode or flight mode to save power. Moreover, it was reported by over 73% of respondents that they sometimes use AC for heating and cooling their rooms, while 6% never use AC. Again, only 34.7% reported warming water for bathing. Respondents mentioned cold weather, disinfection of the water, and allergies to cold water as the main reasons for warming water for bathing.

Moreover, students were asked whether they switched off the lights in the kitchens when they finished cooking. As indicated in **Figure 4**, the findings show that approximately 24.5% of the respondents reported not to switch off lights when they finished cooking. Approximately 51% of the respondents report nothing on the use of the kitchen. They take their meals from the dormitory restaurants.

Refrigerators are among the electric appliances that consume more electricity (Desjardins, 2016). From this study, only 8.2% reported using refrigerators. Twenty eight percent rarely used refrigerators, and approximately 51% of the respondents did not use refrigerators at all (**Figure 5**).

Challenges Facing Students on Energy Supply and Use in Dormitories

It is obvious that residents within the buildings face some challenges regarding energy supply and use in their living places. These challenges may be related to appliances, administration, or the way consumers use energy. Thus, this study aimed to understand whether students face challenges in energy supply and use in their rooms. The findings revealed that 22.4% of the respondents face challenges in energy supply

Table 5. Energy-serving practices by students (n = 49)

No	Study item	Response (%)		
		Always	Sometimes	Never
1	Do you switch off the lights when you leave the room?	75.5	24.5	-
2	Do you switch off the lights when you are asleep at night?	83.7	12.2	4.1
3	Do you switch off your computer laptops or desktops when they are not in use?	59.2	36.7	4.1
4	Do you put the computer laptops or desktops on sleep mode when they are not in use?	30.6	42.9	26.5
5	Do you switch off your phone when you fall asleep?	4.1	12.2	83.7
6	Do you switch on the air conditioning?	20.4	73.5	6.1
7	Do you fill the electric kettle when you need just a cup of water?	24.5	57.1	18.4
8	Do you always use warm water for bathing?	34.7	22.4	42.9

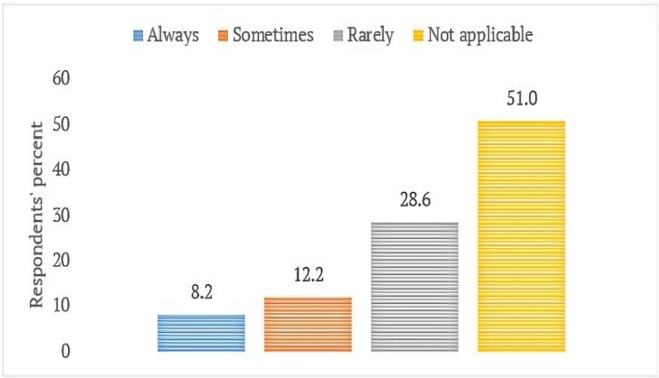

Figure 5. Response to switching off the fridge when not in use (n = 49) (Source: Authors' own elaboration)

and use compared with 77.6% who responded that they do not face any challenge.

Those who responded positively (22.4%) provided some challenges based on the effectiveness of energy supply appliances. For instance, some have argued that the power supply is never consistent. The electricity is off most of the time. This disturbs students' work. Despite Nigeria being Africa's energy giant, it suffers from an insufficient energy supply and uses due to some reasons including rapidly increasing demand (Adewuyi et al., 2020), corruption, underinvestment, and mismanagement (Abraham & Bello, 2017). Moreover, the electricity supply in Nigeria has been privatized to local or foreign businessmen or companies, but this does not appear to be working well (Abraham & Bello, 2017; Roy et al., 2020).

Others mentioned damaged sockets that cannot allow the use of electricity. Surprisingly, other respondents said that they cannot use AC most of the time because it consumes a lot of electricity. The use of AC for heating and cooling in homes consumes a lot of electricity (Fatihah Salleh et al., 2019). For instance, Desjardins (2016) reported that heating and cooling systems consume approximately 47% of the total energy used in homes.

Incentives for Engaging Students in Energy-Saving Behavior

Engaging students in energy saving is considered among the ways that may be used to enhance energy-consuming efficiency in the community (Bull et al., 2018). Thus, it is better to allow students to propose ways to improve energy-saving knowledge, attitudes, and behaviors of the society (Bulunga & Thondhlana, 2018). In this study, students were asked to propose incentives that can be used to improve their knowledge, attitudes and behaviors.

From this study, over 81% propose energy-saving awareness campaigns through training and seminars on the necessity of energy savings among students in academic institutions. In energy saving, awareness is considered among the determinants of human behavior towards energy use (Dumciuviene et al., 2019; Zhao et al., 2019). If a country wants to save energy, citizens must become aware of the energy that they are responsible for and have the power to control. The increased awareness of society may increase simple changes in people's behavior that can quickly lead to significant energy savings (Khan, 2019). Individuals need to acquire energy awareness on

(1) how much energy they use directly or indirectly,

(2) what energy is used for,

(3) where the energy used comes from,

(4) the negative impacts of the energy use (for example, depletion of energy resources, environmental changes, and pollution); (Bishoge et al., 2020a), and

(5) what can they do to minimize the energy consumption and its related negative impacts.

Different energy technologies are aimed at saving energy consumption (Ferreir & Silva, 2020). Society should be aware of these technologies, which include smart metering, solar photovoltaic or solar panels, LED lighting, reflective roofing, solar batteries, home automation, more efficient clothes dryers, smart glass, and home automation (Fallahi & Henze, 2019). Energy-users should be aware of these technologies, which may help them to change their behaviors on reporting leaks and equipment failures on the energy transmission systems; changes in equipment use at both home and working places; and choosing various modes of transport that can save energy (Wehner, 2018).

Other respondents (41%) proposed the use of awards to students who practice energy-savings. This motivates students to continue participating in energy-saving practices. Moreover, more energy-saving projects should be established to change students' behaviors regarding energy use. These projects should also be recognized and awarded for their achievements. For instance, the Students Achieving Valuable Energy Saving Project in Europe promotes energy efficiency by providing good sustainability habits to students (SAVES, 2021). This project was awarded the International Sustainable Campus Network Excellence Award in 2018 (Commission, 2018).

CONCLUSION, LIMITATIONS, AND RECOMMENDATIONS

SD depends greatly on the available and accessible energy supply in all countries. Therefore, it is better to consider human knowledge, attitudes, and behaviors to achieve sustainable energy supply and use in the community. This study was based on postgraduate students, whereby their knowledge, attitudes, and behaviors through assessing their energy-saving practices were examined. From this study, it is evident that most of the respondents practice energy-saving activities in their dormitories. This is interesting and provides additional inputs and compliments on other related studies.

Reported practices do not show the actual attitudes and behaviors of the students because students may respond to bias yes or no answers for socially desirable behaviors with the dormitories' administration. However, these findings provide potential and useful insights into the students on their knowledge, practices on energy saving at the postgraduate level of education. Moreover, this study focused mostly on students' energy-saving practices and their relationship with sociodemographic factors, with no consideration of various

policies and regulations related to energy savings. Thus, further empirical studies should be conducted to assess the interactions between sociodemographic factors, students' energy-saving practices and governmental policies and regulations relating to energy.

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Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

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